

WHAT IS CLAIMED IS:

1 1. A method of measuring comprising:
2 providing an optical metrology target, the optical
3 metrology target comprising:
4 a first periodic structure comprising at least two
5 features, the first periodic structure having a first pitch;
6 and
7 a second periodic structure comprising at least two
8 features, the second periodic structure having a second pitch
9 that differs from the first pitch;
10 illuminating the optical metrology target with a light
11 source;
12 receiving an optical signal from the optical metrology
13 target; and
14 analyzing the optical signal.

1 2. The method of claim 1 in which analyzing the optical
2 signal comprises determining the first pitch.

1 3. The method of claim 2 in which analyzing the optical
2 signal further comprises determining the second pitch.

1 4. The method of claim 3 in which analyzing the optical
2 signal comprises determining the first pitch and the second
3 pitch simultaneously.

1 5. The method of claim 1 in which the measurement is
2 non-destructive.

1 6. The method of claim 1 in which the light source
2 comprises a coherent light source.

1 7. The method of claim 1 in which the light source
2 comprises a non-coherent light source.

1 8. The method of claim 1 in which the light source
2 comprises a light source in the visible spectrum.

1 9. The method of claim 1 in which the light source
2 comprises a light source in the ultraviolet spectrum.

1 10. The method of claim 1 in which analyzing the optical
2 signal comprises using a computer program.

1 11. The method of claim 1, in which the optical
2 metrology target comprises a standalone test pad.

1 12. The method of claim 1, in which the optical
2 metrology target mimics an electrical element.

1 13. The method of claim 12, in which the optical
2 metrology target mimics a circuit structure.

1 14. The method of claim 13, in which the optical
2 metrology target mimics a conductive structure.

1 15. The method of claim 13, in which the optical
2 metrology target mimics an insulated structure.

1 16. The method of claim 15, in which the optical
2 metrology target mimics a flash memory array.

1 17. The method of claim 1, in which the optical
2 metrology target comprises two or more electrical elements.

1 18. The method of claim 1, in which the optical
2 metrology target comprises a circuit structure.

1 19. The method of claim 18, in which the optical
2 metrology target comprises a conductive structure.

1 20. The method of claim 17, in which the electrical
2 element comprises a memory device element.

1 21. The method of claim 17, in which the electrical
2 element comprises a logic device element.

1 22. The method of claim 1 in which each first feature
2 comprises a width less than 100 nanometers.

1 23. The method of claim 1 in which the first pitch is
2 less than 100 nanometers.

1 24. The method of claim 1 in which the first periodic
2 structure is located adjacent to the second periodic
3 structure.

1 25. The method of claim 1 in which the first periodic
2 structure is located so as to overlap the second periodic
3 structure.

1 26. The method of claim 1 in which an axis of the first
2 periodic structure is parallel to an axis of the second
3 periodic structure.

1 27. The method of claim 1 in which an axis of the first
2 periodic structure is aligned with an axis of the second
3 periodic structure.

1 28. The method of claim 1 in which at least one feature
2 of the first periodic structure is a feature of the second
3 periodic structure.

1 29. The method of claim 1 in which at least one feature
2 of the first periodic structure is aligned with a feature of
3 the second periodic structure.

1 30. The method of claim 1 in which at least one feature
2 of the first periodic structure is connected to a feature of
3 the second periodic structure.

1 31. The method of claim 1 in which the features of the
2 first periodic structure comprise nested features.

1 32. The method of claim 31 in which a line-to-space
2 ratio of the features of the first periodic structure
3 comprises a value less than 1:3.

1 33. The method of claim 1 in which the features of the
2 second periodic comprise isolated features.

1 34. The method of claim 33 in which a line--to-space
2 ratio of the features of the second periodic structure
3 comprises a value greater than or equal to 1:3.

1 35. The method of claim 1 in which the optical metrology
2 target further comprises:

3 a third periodic structure comprising at least two
4 features, the third periodic structure having a third pitch;
5 and

6 a fourth periodic structure comprising at least two
7 features, the fourth periodic structure having a fourth pitch
8 that differs from the third pitch.

1 36. The method of claim 35 in which:

2 the first periodic structure and the second periodic
3 structure are aligned with respect to a first axis of the
4 optical metrology target; and

5 the third periodic structure and the fourth periodic
6 structure are aligned with respect to a second axis of the
7 optical metrology target.

1 37. The method of claim 36 in which analyzing the
2 optical signal comprises determining the third pitch.

1 38. The method of claim 31 in which analyzing the
2 optical signal comprises determining the fourth pitch.

1 39. The method of claim 1 in which a shape of at least
2 two features of the first periodic structure comprises a
3 rectilinear shape.

1 40. The method of claim 1 in which a shape of at least
2 two features of the first periodic structure comprises a
3 curvilinear shape.

1 41. The method of claim 1 in which the optical metrology
2 target is provided in a first layer of a device.

1 42. The method of claim 41 further comprising:
2 providing a second optical metrology target in a second
3 layer of the device, the second optical metrology target
4 comprising:

5 a third periodic structure comprising at least two
6 features, the third periodic structure having a third pitch;
7 and

8 a fourth periodic structure comprising at least two
9 features, the fourth periodic structure having a fourth pitch
10 that differs from the third pitch.

1 43. The method of claim 42 in which analyzing the
2 optical signal comprises determining the offset between the
3 optical metrology target in the first layer of the device and
4 the second optical metrology target in the second layer of the
5 device.

1 44. The method of claim 43 in which:
2 the third pitch of the second optical metrology target in
3 the second layer of the device is equal to the first pitch of
4 the optical metrology target in the first layer of the device;
5 and
6 the fourth pitch of the second optical metrology
7 target in the second layer of the device is equal to the
8 second pitch of the optical metrology target in the first
9 layer of the device.

1 45. An optical metrology target comprising:
2 a first periodic structure comprising at least two
3 features, the first periodic structure having a first pitch;
4 and

5 a second periodic structure comprising at least two
6 features, the second periodic structure having a second pitch
7 that differs from the first pitch.

1 46. The optical metrology target of claim 45 in which:
2 each first feature further comprises a length and a
3 width; and
4 each second feature further comprises a length and a
5 width.

1 47. The optical metrology target of claim 46 in which
2 the length of each first feature is equal to the length of
3 each second feature.

1 48. The optical metrology target of claim 47 in which
2 the width of each first feature is equal to the width of each
3 second feature.

1 49. The optical metrology target of claim 46 in which
2 the width of each first feature is less than 100 nanometers.

1 50. The optical metrology target of claim 45 in which
2 the first pitch is less than 100 nanometers.

1 51. The optical metrology target of claim 45 in which
2 the first periodic structure is located adjacent to the second
3 periodic structure.

1 52. The optical metrology target of claim 45 in which
2 the first periodic structure is located so as to overlap the
3 second periodic structure.

1 53. The optical metrology target of claim 45 in which an
2 axis of the first periodic structure is parallel to an axis of
3 the second periodic structure.

1 54. The optical metrology target of claim 45 in which an
2 axis of the first periodic structure is aligned with an axis
3 of the second periodic structure.

1 55. The optical metrology target of claim 45 in which at
2 least one feature of the first periodic structure is a feature
3 of the second periodic structure.

1 56. The optical metrology target of claim 45 in which at
2 least one feature of the first periodic structure is aligned
3 with a feature of the second periodic structure.

1 57. The optical metrology target of claim 45 in which at
2 least one feature of the first periodic structure is connected
3 to a feature of the second periodic structure.

1 58. The optical metrology target of claim 45 in which
2 the features of the first periodic structure comprise nested
3 features.

1 59. The optical metrology target of claim 58 in which a
2 line-to-space ratio of the features of the first periodic
3 structure comprises a value less than 1:3.

1 60. The optical metrology target of claim 45 in which
2 the features of the second periodic comprise isolated
3 features.

1 61. The optical metrology target of claim 60 in which a
2 line-to-space ratio of the features of the second periodic
3 structure comprises a value greater than or equal to 1:3.

1 62. An integrated circuit comprising:
2 at least one electrical element; and
3 an optical metrology target, the optical metrology target
4 comprising:

5 a first periodic structure comprising at least two
6 features, the first periodic structure having a first pitch;
7 and

8 a second periodic structure comprising at least two
9 features, the second periodic structure having a second pitch
10 that differs from the first pitch.

1 63. The integrated circuit of claim 62, in which the
2 optical metrology target comprises a standalone test pad.

1 64. The integrated circuit of claim 62, in which the
2 optical metrology target mimics the electrical element.

1 65. The integrated circuit of claim 64, in which the
2 optical metrology target mimics a flash memory array.

1 66. The integrated circuit of claim 64, in which the
2 optical metrology target comprises a circuit structure.

1 67. The integrated circuit of claim 62, in which the
2 optical metrology target comprises two or more electrical
3 elements.

1 68. The integrated circuit of claim 62 in which the
2 first periodic structure is located adjacent to the second
3 periodic structure.

1 69. The integrated circuit of claim 62 in which the
2 first periodic structure is located so as to overlap the
3 second periodic structure.

1 70. The integrated circuit of claim 62 in which at least
2 one feature of the first periodic structure is a feature of
3 the second periodic structure.

1 71. The integrated circuit of claim 62 in which at least
2 one feature of the first periodic structure is aligned with a
3 feature of the second periodic structure.

1 72. The integrated circuit of claim 62 in which at least
2 one feature of the first periodic structure is connected to a
3 feature of the second periodic structure.

1 73. The integrated circuit of claim 62 in which the
2 optical metrology target further comprises:

3 a third periodic structure comprising at least two
4 features, the third periodic structure having a third pitch;
5 and

6 a fourth periodic structure comprising at least two
7 features, the fourth periodic structure having a fourth pitch
8 that differs from the third pitch.

1 74. The integrated circuit of claim 73 in which:

2 the first periodic structure and the second periodic
3 structure are aligned with respect to a first axis of the
4 optical metrology target; and

5 the third periodic structure and the fourth periodic
6 structure are aligned with respect to a second axis of the
7 optical metrology target.

1 75. The integrated circuit of claim 74 in which the
2 first axis of the optical metrology target is perpendicular to
3 the second axis of the optical metrology target.

1 76. The integrated circuit of claim 74 in which
2 analyzing the optical signal comprises determining the third
3 pitch.

1 77. The integrated circuit of claim 74 in which
2 analyzing the optical signal comprises determining the fourth
3 pitch.

1 78. The integrated circuit of claim 62 in which a shape
2 of at least two features of the first periodic structure
3 comprises a rectilinear shape.

1 79. The integrated circuit of claim 62 in which a shape
2 of at least two features of the first periodic structure
3 comprises a curvilinear shape.

1 80. The integrated circuit of claim 62 in which the
2 optical metrology target is provided in a first layer of a
3 device.

1 81. The integrated circuit of claim 80 further
2 comprising:
3 providing a second optical metrology target in a second
4 layer of the device, the second optical metrology target
5 comprising:
6 a third periodic structure comprising at least two
7 features, the third periodic structure having a third pitch;
8 and

9 a fourth periodic structure comprising at least two
10 features, the fourth periodic structure having a fourth pitch
11 that differs from the third pitch.

1 82. The integrated circuit of claim 81 in which
2 analyzing the optical signal comprises determining the offset
3 between the optical metrology target in the first layer of the
4 device and the second optical metrology target in the second
5 layer of the device.

1 83. The integrated circuit of claim 82 in which:
2 the third pitch of the second optical metrology target in
3 the second layer of the device is equal to the first pitch of
4 the optical metrology target in the first layer of the device;
5 and
6 the fourth pitch of the second optical metrology
7 target in the second layer of the device is equal to the
8 second pitch of the optical metrology target in the first
9 layer of the device.

1 84. An integrated circuit comprising:
2 at least one electrical element; and
3 an optical metrology target, the optical metrology target
4 comprising:

5 a first means for measuring a first periodic structure;

6 and

7 a second means for measuring a second periodic structure.

1 85. The integrated circuit of claim 84, in which the

2 optical metrology target comprises a standalone test pad.

1 86. The integrated circuit of claim 84, in which the

2 optical metrology target mimics the electrical element.

1 87. The integrated circuit of claim 84, in which the

2 optical metrology target mimics a circuit structure.

1 88. The integrated circuit of claim 86, in which the

2 optical metrology target mimics a memory device element.

1 89. The integrated circuit of claim 84, in which the

2 optical metrology target comprises two or more electrical

3 elements.

1 90. The integrated circuit of claim 84 in which:

2 the first means for measuring a first periodic structure

3 comprises a means for measuring a first pitch of the first

4 periodic structure; and

5 the second means for measuring a second periodic
6 structure comprises a means for measuring a second pitch of
7 the second periodic structure;
8 in which the second pitch differs from the first pitch.